

Environmental Laboratories

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Introduction

The Environmental Laboratories provide quality analytical support to the Tennessee Department of Environment and Conservation's (TDEC) Environmental Regulatory Divisions: Air Pollution Control, Radiological Health, DOE/Oak Ridge Oversight, Underground Storage Tanks, Drinking Water Supply, Water Pollution Control, State Superfund, Groundwater Protection, and Solid Waste Management. Other state departments that are served on a more limited basis include the Office of the Attorney General and the Departments of Agriculture, Corrections, Finance and Administration, Health, Labor, Tourism, and Transportation.

The Environmental Laboratories provide timely, reliable and economical analytical work by maintaining a well-trained staff and state of the art instrumentation and by using Environmental Protection Agency (EPA) approved methodologies. The results generated by the Environmental Laboratories are used in administrative decision-making processes, permit monitoring, enforcement actions, clean-up programs, and criminal investigations.

All samples submitted for analysis should be properly collected in bottles furnished and prepared by the Environmental Laboratories. Proper collection and preservation steps must be taken to assure quality data. Consult with the nearest Environmental Laboratory (Jackson, Knoxville, or Nashville) for more information.

Aquatic Biology

The Aquatic Biology Section performs biological analyses to determine the impact of pollution on Tennessee's waterways. The functional scope of the section requires coordination with other state and federal agencies to accomplish common goals. The schedule of duties is largely determined by the TDEC Division of Water Pollution Control and other agencies that require water pollution related biological data. These analyses include:

- Stream surveys of fish and macroinvertebrate communities using quantitative and qualitative methods to ascertain the impacts of instream pollution.
- Collection and analyses of fish flesh for toxic chemical residues.
- Toxicity testing of industrial and municipal effluents in support of the National Pollution Discharge Elimination System.
- Toxicity tests in circumstances where contaminants are suspect in any body of water.
- Other analyses as needed in support of the requesting environmental program areas.

The waterflea, *Ceriodaphnia dubia*, and the fathead minnow, *Pimephales promelas*, are used in the performance of acute and chronic toxicity tests.

Organic Chemistry

The Organic Analysis Section uses sophisticated instrumentation to detect hundreds of pollutants in the parts-per-billion range. Many types of samples from all over the state are analyzed in support of state and federal environmental regulations, such as the Safe Drinking Water Act, the Resource Conservation and Recovery Act, Underground Storage Tank rules, permitting activities, and well-head protection. The four units that comprise the Organic Analysis Section are the:

- Petroleum Analysis Unit that examines water and sediment for gasoline and diesel fuel as well as components of petroleum fuels such as the carcinogen benzene.

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- Sample Preparation Unit that extracts all base/neutral/acid pollutants and processes the extracts for testing.
- Extractable Analysis Unit that tests for pollutants such as pesticides, herbicides, plasticizers, and coal-tar derivatives that may be found in drinking water, wastewater, soils, wastes, and fish tissues.
- Volatiles Analysis Unit that tests for common drinking water contaminants and many industrial solvents in samples submitted to the unit from landfills and Superfund sites.

Inorganic Chemistry

The Inorganic Chemistry section contains the General Inorganics unit, the PM_{2.5} Air Filter unit, and the Metals unit, and analyzes various matrices for inorganic characteristics and contaminants affecting the environmental quality of the State of Tennessee. Sample matrices tested most frequently are water, soil, and air filters.

- The General Inorganics unit performs a wide variety of analytical techniques including traditional wet bench chemistry, gravimetry, colorimetry, and UV/Visible spectrometry. Instruments and equipment include pH/ion specific electrode meters, a turbidimeter, digital titrators, a UV/Visible spectrometer, a dissolved oxygen meter, a flash point tester, a total organic carbon analyzer, a total random automated access colorimetry system, and a discrete analyzer. Tests include biochemical oxygen demand (BOD), chemical oxygen demand (COD), cyanide, nitrogen analysis, total phosphate, pH, fluoride, flashpoint, hardness, alkalinity and acidity, turbidity, oil and grease, and solids to name a few.
- The particulate matter size 2.5 μ or smaller (PM_{2.5}) Air Filter unit performs gravimetric analysis for the measurement of fine particulate matter as PM_{2.5} in ambient air on 46 mm Teflon filters. The unit takes the filter all the way through the analytical process of initial conditioning and weighing of the unexposed filter, to shipping to the field, receiving from the field after exposure, final weighing, calculation of mass concentrations, reporting of data, and archival of the exposed filters. This unit serves agencies at both the State and local municipality level.
- The metals unit employs atomic absorption and atomic emission spectroscopy for the analysis of environmental samples for metals. Atomic absorption techniques include flame, graphite furnace, and cold vapor techniques. Atomic emission is accomplished with the use of inductively coupled plasma. A broad range of metals can be determined by these methods including arsenic, cadmium, chromium, copper, and iron to name a few. The unit also performs the toxicity characteristic leaching procedure (TCLP) to determine the mobility of metals in soil and wastes.

Radiochemistry

The Radiochemistry Laboratory is a section within the Environmental Chemistry Division of Laboratory Services. The primary function of the Radiochemistry Laboratory is the analysis of environmental samples for the presence of low levels of radionuclides. By definition, the Radiochemistry Laboratory is a low level radiation laboratory. In other words, the majority of samples received have levels of radiation that are just at or below normal environmental levels.

- The Radiochemistry Laboratory receives environmental monitoring samples from Sequoyah Nuclear Plant, Watts Bar Nuclear Plant, Nuclear Fuel Services and large radioactive material license holders. In addition, there are numerous environmental monitoring programs both on and off the Oak Ridge Reservation that generate a large number of samples requiring analyses for radiochemical parameters as well as other inorganic and organic parameters.
- The Radiochemistry Laboratory tests a wide variety of sample matrices, such as water, milk, soil, sediment, vegetation, fish, sludge and air filters. All sample matrices are analyzed for alpha, beta and/or gamma radiation.

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- Numerous analytical techniques are used to prepare samples for analysis. These include ashing, acid digestion, precipitation, distillation, centrifugation, and ion exchange chromatography.
- The Radiochemistry Laboratory employs sophisticated radioanalytical instrumentation in the analysis of environmental samples. For alpha and beta analysis, the Laboratory has three low-background gas proportional gross alpha-gross beta counters. For gamma analysis, the Laboratory has two low-background high purity germanium detectors coupled with contemporary software and electronics.

Sample Submittal

The State of Tennessee's Environmental Laboratory is a professional environmental team in partnership with Tennessee's Department of Environment and Conservation and other state agencies. This partnership is dedicated to protecting and improving the environmental health of Tennessee for its citizens. Our role is to provide scientific information and high quality, cost-effective, accurate and precise analytical support with integrity, and to assist other laboratories in providing the highest quality service available.

General Information

- **Only authorized personnel of the environmental regulatory agencies in the Department of Environment and Conservation and other state agencies contracted with the Environmental Laboratories may submit samples.**
- Use the proper sample containers. These may be obtained from your nearest State of Tennessee Environmental Laboratory.
- Observe preservation requirements as outlined in Chart **VI - 2**, INORGANIC ANALYSIS: BOTTLES AND PRESERVATIVES, page **VI – 15** and page **VI- 16** . Ice all samples.
- When sampling, remember that preserved bottles contain hazardous reagents. Material Safety Date Sheets (MSDSs) are available at the laboratory for your use.
- The forms are printed on **No Carbon Required (NCR) paper**. The sampler will keep the yellow copy when the sample is brought to the laboratory.
- The chain of custody information, the sample identification information, and the analyte checklist are on one side of the sheet.
- The analyte checklists on each sheet are organized according to analytical methodology or regulatory program interests.
- The request sheets are not report sheets (except for the Biological Analysis sheet), therefore results will not be reported on these sheets.

The following Environmental Sample Request Sheets are available:

- Organic Analysis -- Base/Neutral/Acid Extractables
- Organic Analysis -- Volatiles and Petroleum Hydrocarbons
- Inorganic Analysis
- Safe Drinking Water Parameters – includes both organic and inorganic parameters
- Biological Analysis

Instructions for Completing Environmental Sample Request Sheets

Organic Analysis -- Base/Neutral/Acid Extractables
Organic Analysis -- Volatiles and Petroleum Hydrocarbons
Inorganic Analysis
Safe Drinking Water Parameters

See page VI - 24 for Biological Analysis Sample Request Sheets and page VI - 28 for Radiochemical Analysis Sample Request Sheets.

Sample Identification Information

The information is located in the upper left-hand shaded box. It must be filled out completely by the sampler.

1. **Project/Site No.:** The unique number that is designated by the program area/sampling agency. This does not need to be filled out if there is no project or site number associated with the sample.
2. **Project Name:** The designated name for the project number entered in Project/Site No. above. The project name should be the focus of the field investigation. (For example, EZ Leak Industry has had an industrial spill and several residential wells are sampled to determine the extent of contamination. The project name will be EZ Leak.) It is also used for sites with no project number that is part of a larger investigation.
3. **Station Number:** The field number assigned by the sampler that uniquely identifies the point at which the sample was taken. (For example W1.)
4. **County:** Designated by the two-digit county code used by state agencies.
5. **Description:** A complete description of the location at which the sample was taken. (For example D. C. Smith residence for the EZ Leak Project in 2 above. Other description examples are Dirty Creek 500 yds upstream of industry Q or @ Industry Q waste pit #1.)
6. **Stream Mile:** The stream mile of a navigable river or stream.
7. **Depth:** May be the depth sampled for a core sample of soil or the depth at which a water sample was collected in a well or body of water.
8. **Matrix:** The sample type. (For example water, sediment, or industrial waste.)
9. **Collection Date:** The date the sample was collected.
10. **Time:** The time that the sample was collected in military time (24-hour clock time).
11. **Sampler's Name:** Include the first and last name **printed legibly**.
12. **Sampling Agency:** The agency for which the sample was collected. (For example UST or WPC.)
13. **Billing Code:** The TDEC billing code and cost center for purchase of laboratory services assigned to the various TDEC programs to which the analyses performed on a sample are billed. (For example 327.41-08 or 327.34-21.)

Sample Identification Information (continued)

14. **If Priority, Date Needed:** Must be filled out if the analytical results are needed by a particular date as determined by health effect emergency or program-determined priority. ASAP is never appropriate.
15. **Send Report To:** The person's name and complete address where the sample report should be sent.
16. **Contact Hazard:** A listing of any known hazards related to the sample (radiological, chemical, or biological). Do not put none. Write unknown if you are not aware of a hazard. (For example hydrocarbon -- strong odor, organic solvents, pure gasoline, or poison ivy.)

**Figure VI - 1
Sample Identification Information**

State of Tennessee -- Environmental Laboratories
PLEASE PRINT LEGIBLY



PROJECT/SITE NO. 3-19022		PROJECT NAME EZ LEAK	
STATION NUMBER W1		COUNTY 19	
DESCRIPTION D C Smith Residence			
STREAM MILE	--	DEPTH	--
COLLECTED: DATE 3/28/01		TIME 0815	
SAMPLER'S NAME (PRINTED) M N FIELD			
SAMPLING AGENCY UST		BILLING CODE 327.41-08	
IF PRIORITY, DATE NEEDED 4/4/01			
SEND REPORT TO: M N FIELD, UST			
NASH BASIN OFFICE			
CONTACT HAZARD Possible hydrocarbon -- strong odor			

Chain of Custody and Supplemental Information

A Chain of Custody is required by the TDEC Office of the General Counsel for samples whose laboratory results may be used in a court of law, reviewed by state boards, involved in state hearings, or used in any other legal capacity. Chain of Custody documents must be filled out in their entirety to meet legal requirements.

1. The sampler signs his/her name in full in the **Collected By** space, along with the date and time of day calculated in military time.
2. Prior to the arrival of the sample at the laboratory, complete documentation must be made for all individuals who had custody of the sample at any time. Each individual responsible for the sample must sign his/her full name on the **Received By** space along with the date and time of day calculated in military time. Upon arrival at the laboratory, the laboratory representative who receives the sample will sign line 4.
3. Completely fill out all the information under **Additional Information** including:
 1. Approximate volume of sample.
 2. Nearest town or city.
 3. Others present at collection.
 4. Number of other samples collected at the same time at this point.
 5. Field collection procedure, handling, and/or preservation of this sample (can write SOP if a written SOP was followed).
 6. Mode of transportation to the laboratory (state vehicle, bus, UPS, etc.).
 7. Sample/cooler sealed by.
 8. Date sample/cooler sealed.
 9. Remarks (if needed.)

Figure VI - 2
Chain of Custody and Supplemental Information

Only one chain of custody form is required per sample set or point (if all collected at the same time)

1.	Collected by <i>Mary N. Field</i>
	Date <i>3/28/01</i> Time <i>0815</i>
	Delivered to <i>Bob Smith</i>
	Date <i>3/28/01</i> Time <i>1300</i>
2.	Received by <i>Bob Smith</i>
	Date Time
	Delivered to <i>Lab</i>
	Date Time
3.	Received by
	Date Time
	Delivered to
	Date Time
4.	Received in Lab by <i>Leo Barriociere</i>
	Date <i>3/29/01</i> Time <i>0920</i>
	Logged in by <i>Leo Barriociere</i>
	Date <i>3/29/01</i> Time <i>1000</i>
Additional information	
1.	Approximate volume of sample
	<i>4 Liters</i>
2.	Nearest town or city <i>Joelton</i>
3.	Others present at collection <i>Charles, Jones, EZ leak</i>
4.	Number of other samples collected at same time at this point
	<i>4</i>
5.	Filed collection procedure, handling and/or preservation of this sample
	<i>Acc to SOP</i>
6.	Mode of transportation to lab
	<i>State vehicle</i>
7.	Sample sealed by <i>M N Field</i>
8.	Date sample sealed <i>3/28/01</i>
9.	Remarks